

Idaho National Laboratory

The Tritium Plasma Experiment: Status and Plans

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Plasma Facing Components Program Meeting

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Outline

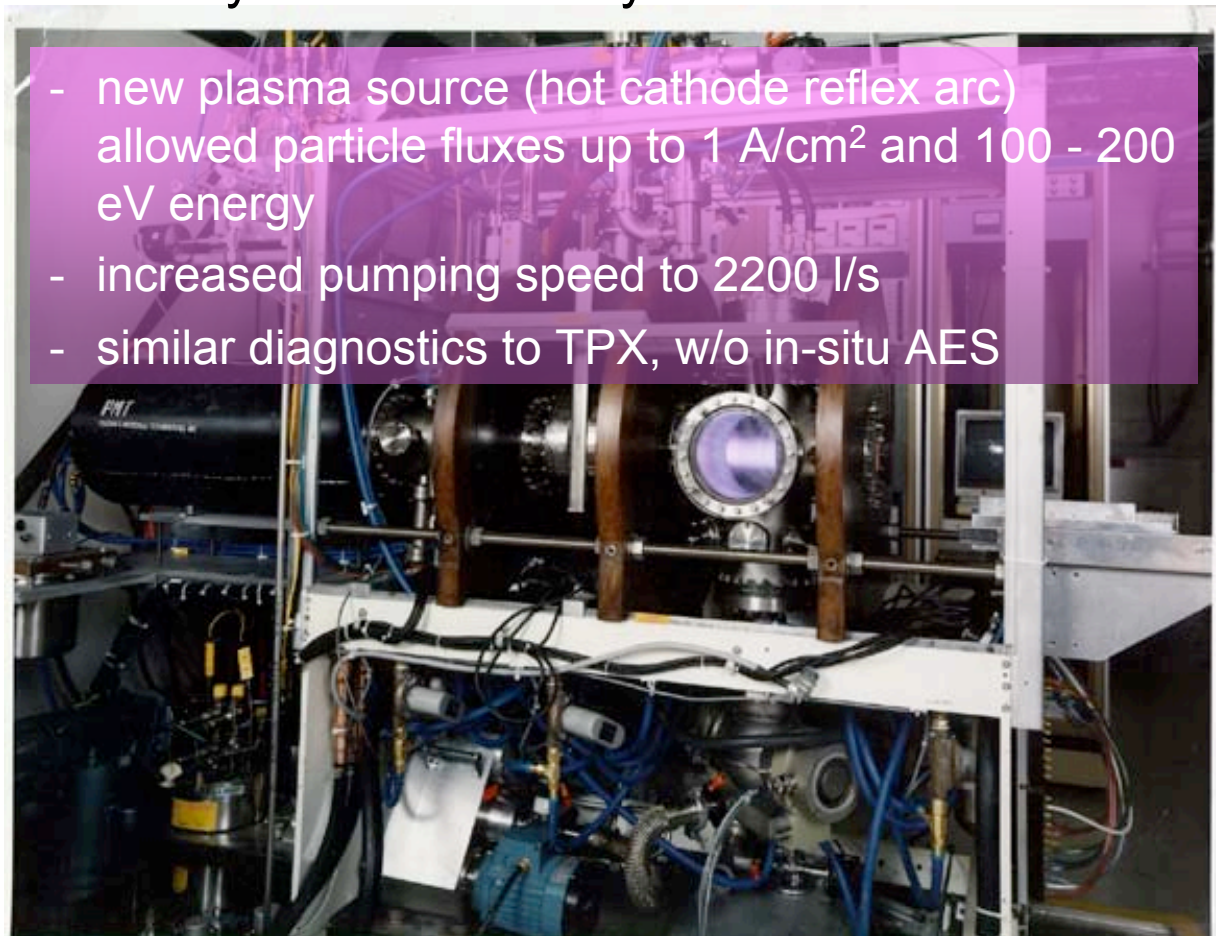
- TPE History
- New Home at INL's STAR Facility
- Reassembly Work
- Return to Experiments

TPE History

- established as the ***Tritium Plasma Experiment (TPX)*** in 1982 at the Tritium Research Laboratory at Sandia-Livermore; TPX operated for ~ 10 years
 - uniquely capable of H-D-T plasmas for PSI studies, primarily measuring plasma-driven permeation behavior of metals and graphites
 - RF driven plasma (390 MHz) up to 200 W; axially magnetized to ~ 150 G
 - plasma density $\sim 3 \times 10^{11}$ ions/cm³, $T_e \sim 10$ eV, on-sample ion flux 10 mA/cm²
 - T throughput ~ 0.1g/day; experiment placed in a high-velocity ventilation hood for T contamination control; pumping system exhausted to TRL vacuum effluent recovery system
 - diagnostics included Langmuir probes, QMS (plasma species and permeation species), in-situ AES

TPE History, cont.

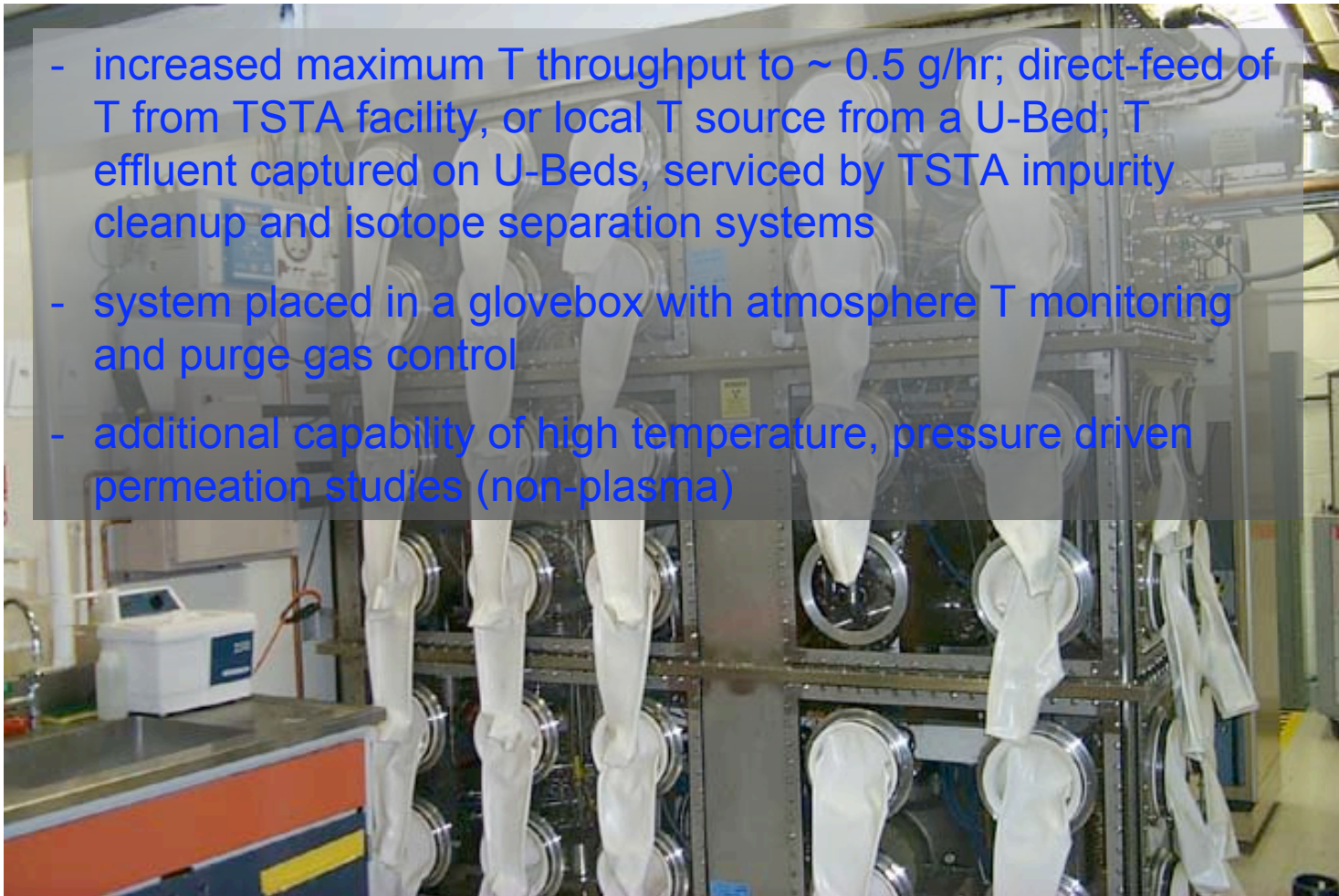
- experiment system upgraded and moved to the Tritium Systems Test Assembly at LANL in early 1990's



TPE History, cont.

- TPE returned to T operation in May 1995

- increased maximum T throughput to ~ 0.5 g/hr; direct-feed of T from TSTA facility, or local T source from a U-Bed; T effluent captured on U-Beds, serviced by TSTA impurity cleanup and isotope separation systems
- system placed in a glovebox with atmosphere T monitoring and purge gas control
- additional capability of high temperature, pressure driven permeation studies (non-plasma)



TPE History, cont.

- decision in 2001 to close TSTA operations forced relocation of TPE



New Home at INL's STAR Facility

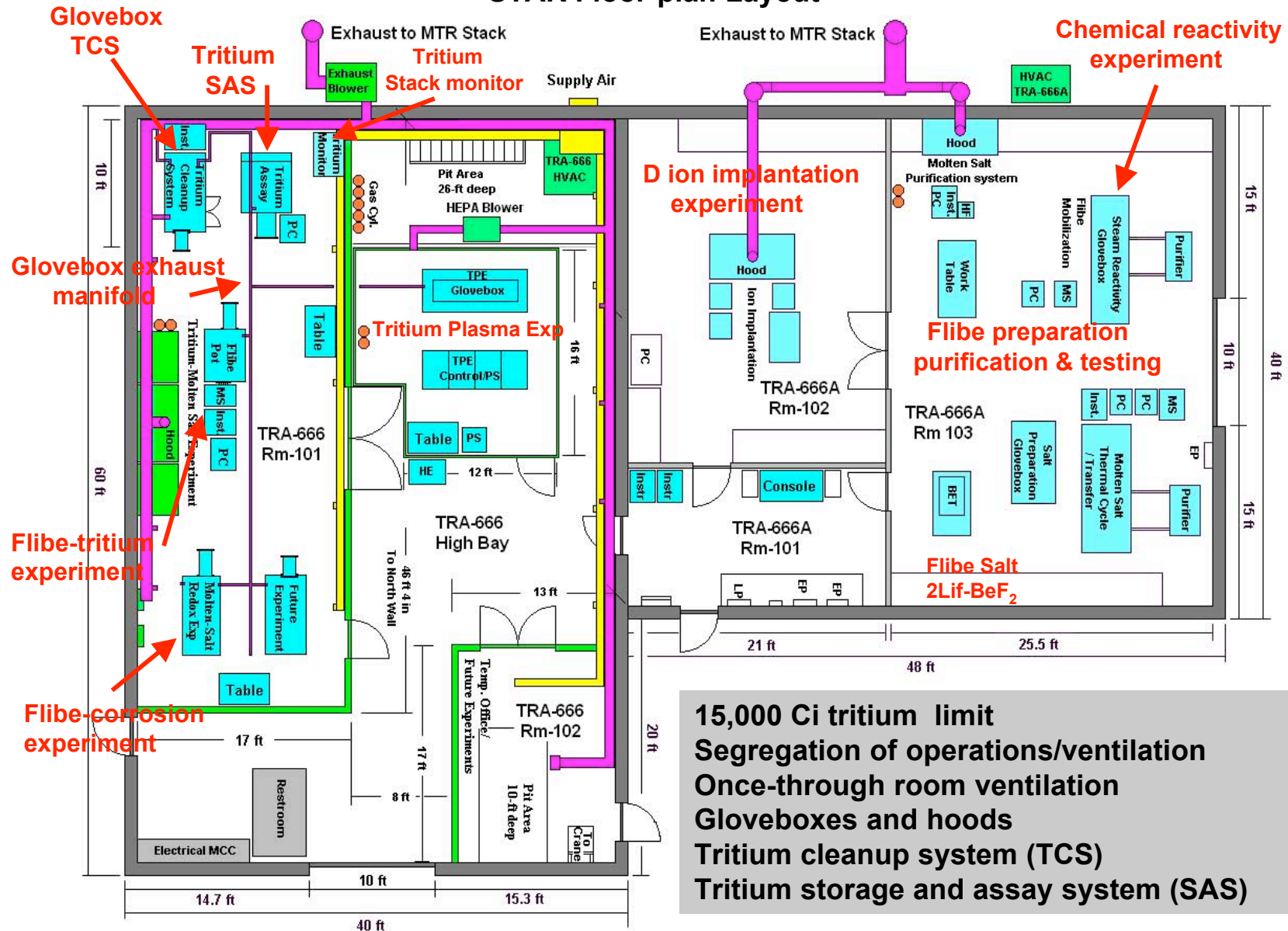
- TPE arrived at INL in April 2002



New Home at INL's STAR Facility, cont.

- changed plans for experiment location due to high levels of T contamination
 - levels as high as 300,000 dpm / 100 cm² located within instrument racks and power supply chassis (CA limit is 10,000 dpm / 100 cm²)
 - decontamination efforts unsuccessful at reducing levels below CA limit
 - TPE will have a dedicated room in the facility, minimizing contamination spread, and reducing impact on other STAR systems or experiments
 - substantial facility modifications were required to enact changed plans: purchase and erect a PermaCon enclosure, re-route and expand electrical service, modify facility ventilation, extend the fire suppression system into the PermaCon

STAR Floor-plan Layout



15,000 Ci tritium limit
Segregation of operations/ventilation
Once-through room ventilation
Gloveboxes and hoods
Tritium cleanup system (TCS)
Tritium storage and assay system (SAS)

New Home at INL's STAR Facility, cont.



PermaCon enclosure housing
TPE and ancillary equipment.



Auxiliary blower and HEPA
filter for room ventilation.

Reassembly Work

- Experiment systems to be reassembled and tested; activities include:
 - install electrical service for PermaCon and distribution switchgear
 - installation and checkout of cabling and power leads
 - configure and install cooling systems (external); checkout and purge cooling lines inside glovebox
 - evaluate condition and test out electro-pneumatic control valve system
 - install gas supply manifold to service plasma and glovebox systems
 - glovebox integrity testing, purge gas monitoring and control system installation, glove replacement
 - test vacuum system components, conditions vacuum system (new TMP, roughing pump, and controls)
 - test I&C instrumentation (heaters, flow controllers, PS controllers, etc.)
 - refurbish plasma source
 - modify operations procedures, and write ES&H documentation

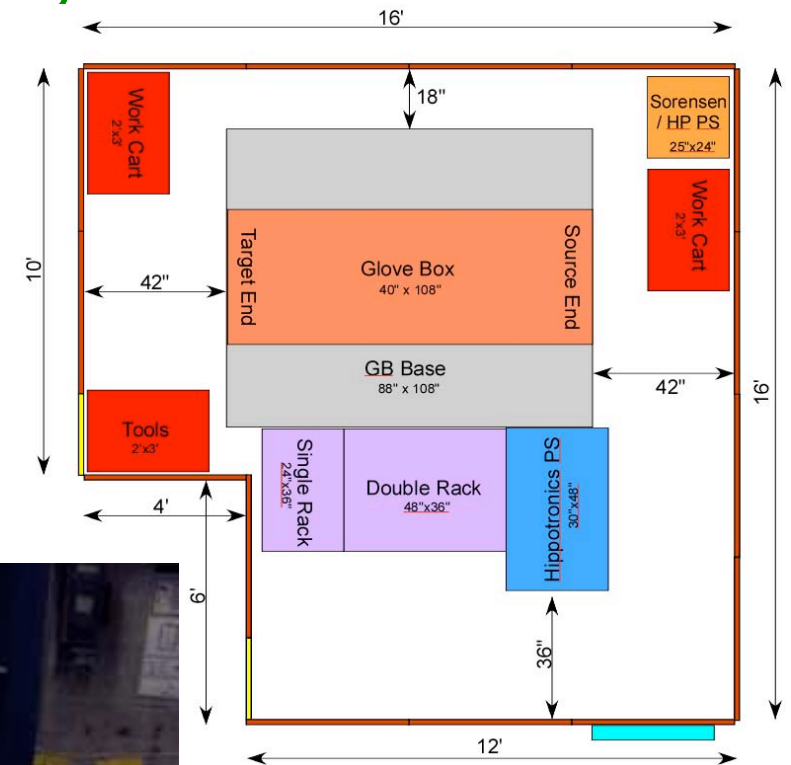
Reassembly Work, cont.



Room ventilation exhausted through the TPE glovebox.

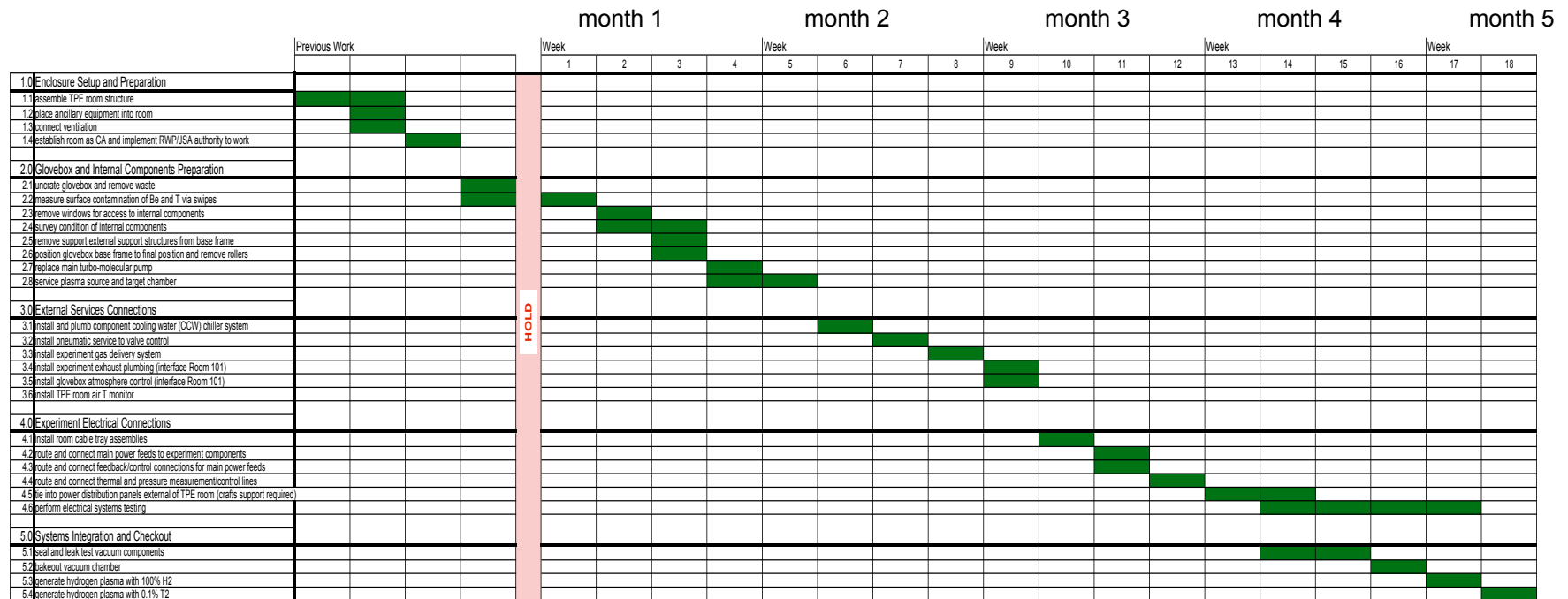


Testing TPE I&C lines going to glovebox feedthroughs.



Reassembly Work, cont.

- updated schedule



Full plasma operation w/T expected June 2005
(barring other unexpected difficulties)

Return to Experiments

- TPE will again be available for continued support of the PFC community
- Experiment conditions and diagnostics will not change, except T throughput will be much reduced (~0.1 g/day)
- Some of the near-term experiments include:
 - re-investigation of T permeation in W
 - T uptake and retention in Be-W mixed materials
 - other mixed materials work, possibly w/ carbon
 - pressure-driven permeation studies of advanced materials/coatings